MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

PEM0044 – ESSENTIALS MATHEMATICS

(All sections / Groups)

4 June 2018
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages with 4 questions only, excluding the cover page.

2. Attempt ALL FOUR questions.

3. Write all your answers in the Answer Booklet provided. Show all necessary workings.

4. The formula sheet is attached at the end of this question paper.

Question 1 (25 marks)

(a) What is the domain and range of the function $f(x) = |2x + 1| + 1$?

[4 marks]

(b) Completely factorize the cubic $(v) = v^3 - 3v^2 + v - 3$.

[3 marks]

(c) Use the quadratic formula to find the roots of $f(x) = x^2 - 2x - 4$.

[3 marks]

(d) Find the equation of a line that is perpendicular to the line $y = \frac{-1}{2}x + 3$ and passes through a point (4, -2).

[4 marks]

(e) Rationalize the denominator $\frac{\sqrt{2}+\sqrt{3}}{\sqrt{5}-\sqrt{6}}$ and simplify the fractions.

[5 marks]

(f) Solve $-3 < \frac{-2x-7}{5} < 7$.

[6 marks]

Question 2 (25 marks)

(a) (i) Express the following pair of simultaneous equations in matrix form.

$$2x - 5y = 6 \text{ and } 4x + 3y = 38$$

[2 marks]

(ii) Using a matrix method, solve this system of equations. [5 marks]

(b) Given that matrix $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$,

(i) Find $2A - A^2$

[5 marks]

(ii) Compute $2I - A$, where $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, and shows by using matrix multiplication that this answer is the inverse of matrix A.

[3 marks]

Continued...

(c) Find the determinant of square matrix below:

(i) $A = \begin{bmatrix} 3 & 8 \\ 4 & 6 \end{bmatrix}$

[3 marks]

(ii) $B = \begin{bmatrix} 2 & -1 & 0 \\ 3 & -5 & 2 \\ 1 & 4 & -2 \end{bmatrix}$

[7 marks]

Question 3 (20 marks)

(a) Given two terms in the arithmetic sequence, $a_5 = -8$ and $a_{25} = 72$. Write a rule formula that can find any term in the arithmetic sequence.

[12 marks]

(b) Consider a geometric sequence that has a first term $\frac{1}{8}$ and an 7th term of 512.

(i) Find the common ratio. [4 marks]

(ii) Find the third term. [2 marks]

(iii) Find the sum of the first five terms. [2 marks]

Question 4 (30 marks)

(a) Find $\frac{d}{dx}(x^4 - 3x^3 + 17x)$

[3 marks]

(b) $f(x) = \sqrt[3]{x^2 + 2}$. Find $f''(5)$

[11 marks]

Continued...

(c) Differentiate the following functions using *product rule* and *quotient rule*

(i) $y = (27 - 8x^3)(x^2 + x)$

[4 marks]

(ii) $y = \dfrac{6}{4t^2 + 3t - 22}$

[4 marks]

(d) Integrate the following functions:

(i) $\int \left(\dfrac{12x^{10} - 5x^6 + 3x^2}{x^2} \right) dx$

[4 marks]

(ii) Evaluate $\int_1^5 (x^3 + 3)dx$

[4 marks]

End of Page.

COURSE CODE: PEM0044
COURSE NAME: ESSENTIAL MATHEMATICS

FORMULAE

1. Differentiation

The Power Rule: $$\frac{d}{dx}\left[x^n\right] = nx^{n-1}$$

The Product Rule: $$\frac{d}{dx}\left[uv\right] = u\frac{dv}{dx} + v\frac{du}{dx}$$

The Quotient Rule: $$\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

The Chain Rule:

$$\frac{dy}{dx} = \frac{dy}{du} \bullet \frac{du}{dx}$$

If n any real number, $u = g(x)$ is differentiable, then

$$\frac{d}{dx}\left[u^n\right] = nu^{n-1} \times \frac{du}{dx}$$

2. Integration

i) $\int k\,dx = kx + C$

ii) $\int x^n\,dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$

iii) $\int cf(x)\,dx = c\int f(x)\,dx$

iv) $\int [f(x) \pm g(x)]\,dx = \int f(x)\,dx \pm \int g(x)\,dx$